

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
SOUTHERN NUCLEAR OPERATING CO.) Docket No. 52-011-ESP
)
(Early Site Permit for Vogtle ESP Site))

NRC STAFF TESTIMONY OF MARK D. NOTICH, ANNE R. KUNTZLEMAN,
REBEKAH H. KRIEG, DR. CHRISTOPHER B. COOK, AND LANCE W. VAIL
CONCERNING ENVIRONMENTAL CONTENTION EC 6.0

Q1. Please state your names, occupations, and by whom are you employed.

A1(a). (MDN) My name is Mark D. Notich. (MDN) I am employed as a Senior Project Manager in the Division of Site and Environmental Reviews, Office of New Reactors, U.S. Nuclear Regulatory Commission ("NRC"). I am the NRC Project Manager for the environmental review associated with the application submitted on August 14, 2006, by Southern Nuclear Operating Company, Inc. ("Southern" or "Applicant") for an early site permit ("ESP") for a site within the existing Vogtle Electric Generating Plant ("VEGP") site near Waynesboro, GA. A statement of my professional qualifications is attached hereto.

A1(b). (ARK) My name is Anne "Nancy" R. Kuntzleman (ARK). I am employed as an Aquatic Biologist in the Division of Site and Environmental Reviews, Office of New Reactors, NRC. I am a technical reviewer for the NRC on aquatic and terrestrial resources issues associated with the application submitted on August 14, 2006, by Southern for an ESP for a site within the existing VEGP site near Waynesboro, GA. A statement of my professional qualifications is attached hereto.

A1(c). (RHK) My name is Rebekah H. Krieg (RHK). I am employed as a Senior Research Scientist in the Ecology Group, Environmental Sustainability Division, Energy and

Environment Directorate of the Pacific Northwest National Laboratory (“PNNL”). I am a technical reviewer for PNNL’s contract with the NRC on aquatic resource issues associated with the application submitted on August 14, 2006, by Southern for an ESP for a site within the existing VEGP site near Waynesboro, GA. A statement of my professional qualifications is attached hereto.

A1(d). (CBC) My name is Dr. Christopher B. Cook (CBC). I am employed as a Senior Hydrologist in the Division of Site and Environmental Reviews, Office of New Reactors (NRO), NRC. I was employed as a Senior Research Engineer at PNNL and was assigned as the lead technical reviewer on hydrology issues for PNNL’s contract with the NRC when the application was submitted on August 14, 2006, by Southern for an ESP for a site within the existing VEGP site near Waynesboro, GA. While at PNNL, I assisted with the development of portions of NUREG-1872, “Draft Environmental Impact Statement for an Early Site Permit (ESP) at the Vogtle Electric Generating Plant Site,” September 2007 (“DEIS”), relating to hydrological alterations, water use, and water quality issues. As part of my current employment, I was a technical reviewer for the NRC on hydrological alterations, water use, and water quality issues associated with the Vogtle ESP. A statement of my professional qualifications is attached hereto.

A1(e). (LWV) My name is Lance Vail (LWV). I am employed as a Sr. Research Engineer in the Hydrology Group, Environmental Sustainability Division, Energy and Environment Directorate of PNNL. I am a technical reviewer for PNNL’s contract with the NRC on hydrological alterations, water use, and water quality issues associated with the application submitted on August 14, 2006, by Southern for an ESP for a site within the existing VEGP site near Waynesboro, GA. A statement of my professional qualifications is attached hereto.

Q2. Please describe your current responsibilities in relation to this review.

A2(a). (MDN) As the NRC Project Manager for the environmental review, I was responsible for overseeing the preparation of NUREG-1872, the “Final Environmental Impact

Statement for an Early Site Permit (ESP) at the Vogtle Electric Generating Plant Site,” August 2008 (“FEIS”) (Exhibit NRC000001).

A2(b). (ARK) In my capacity as the aquatic biologist assigned to the VEGP ESP review, I provided technical oversight to the PNNL reviewers during the preparation of Sections 2.7.2 (Aquatic Ecology), 4.4.2 (Aquatic Impacts from Construction), 5.4 (Ecological Impacts from Operation), and 7.5 (Aquatic Ecosystem - Cumulative Impacts) of the FEIS.

A2(c). (RHK) In my current responsibility as the aquatic ecology technical reviewer assigned to the VEGP ESP review, I wrote the descriptive information contained in Section 2.7.2 and performed the review of the impact to aquatic organisms due to interactions with the proposed station intake and discharge structures as presented in Sections 5.4 and 7.5 of the FEIS. I worked under the technical oversight of Dr. Michael T. Masnik and Ms. Nancy Kuntzleman of the NRC.

A2(d). (CBC) As part of my official responsibilities at PNNL as a hydrology technical reviewer to the VEGP ESP review, I evaluated the surface water hydrology and plant water systems documented in Chapters 2, 3, 4, 5, 7 and 9 of the DEIS. As part of my official responsibilities at the NRC as the hydrology technical reviewer assigned to the VEGP ESP review, I was responsible for reviewing the analysis prepared by Mr. Vail (LWV) related to surface water hydrology and plant systems until March 2008. Although I was not a technical reviewer on the application during completion of the FEIS, I am familiar with the Staff's analysis and conclusions documented in Chapters 2, 3, 4, 5, 7, and 9 of the FEIS concerning surface water hydrology and plant water systems.

A2(e). (LWV) In my current responsibility as the hydrology technical reviewer assigned to the VEGP ESP review, I am responsible for the analysis related to surface water and plant water systems documented in Chapters 2, 3, 4, 5, 7, and 9 of the FEIS. I assumed responsibility as the PNNL hydrology technical reviewer following publication of the NRC Staff's Draft Environmental Impact Statement (“DEIS”) in September 2007.

Q3. What is the purpose of this testimony?

A3. (ALL) The purpose of this testimony is to present the NRC Staff's views with respect to Contention EC 6.0, which challenges the adequacy of the analysis in the FEIS of potential cumulative impacts associated with the possible dredging of the Savannah River Federal navigation channel, as well as of potential upstream reservoir operations, to support river navigation.

Q4. Are you familiar with Contention 6.0?

A4. (ALL) Yes. Contention EC 6.0, submitted in this proceeding by the Center for a Sustainable Coast, Savannah Riverkeeper, Southern Alliance for Clean Energy, Atlanta Women's Action for New Directions, and Blue Ridge Environmental Defense League (collectively, "Joint Intervenors"), as restated by the Atomic Safety and Licensing Board in its Memorandum and Order of October 24, 2008, ruling on the Applicant's Motion for Summary Disposition, alleges that:

Because Army Corps of Engineers (Corps) dredging of the Savannah River Federal navigation channel has potentially significant impacts on the environment, the NRC staff's conclusion, as set forth in the "Cumulative Impacts" chapter of the FEIS, that such impacts would be moderate is inadequately supported. Additionally, the FEIS fails to address adequately the impacts of the Corps' upstream reservoir operations as they support navigation, an important aspect of the problem.

We are familiar with the contention and the bases submitted in its support presented in the Joint Intervenors' filing dated September 22, 2008, as well as with the declarations of Shawn Paul Young, Ph.D. dated September 22, 2008, and the declaration of Donald F. Hayes, dated September 21, 2008. It is our understanding that the contention concerns the possible environmental impacts of dredging of the Federal navigation channel on aquatic biota as well as postulated impacts to the Savannah River basin, if releases were made from upstream reservoirs to provide flows necessary to facilitate barge traffic to the VEGP site.

Q5. Please describe how you prepared for this testimony.

A5. (ALL) Our assessment of the impacts to aquatic biota in the Savannah River, including impacts due to potential dredging activities on the Savannah River, is presented in the FEIS. Our testimony therefore focuses on the Staff analysis documented in the FEIS. However, in preparing this testimony we have also considered the “U.S. Army Corps of Engineers Testimony of William G. Bailey, Carol L. Bernstein, Lyle J. Maciejewski, and Stanley L. Simpson Concerning Environmental Contention 6.0” provided on January 9, 2009, by the Corps of Engineers, Savannah District (hereinafter “USACE Testimony”), as well as the following specific documents:

NUREG-1555, Standard Review Plans for Environmental Reviews for Nuclear Power Plants (“ESRP”) Rev. 1 (2007) (Exhibit NRC000010).

US Army Corps of Engineers, ER-1105-2-100, PLANNING GUIDANCE NOTEBOOK (2000) (Exhibit NRC000048).

US Army Corps of Engineers, ER-200-2-2 PROCEDURES FOR IMPLEMENTING NEPA (1988) (Exhibit NRC000049).

I. Basis for NRC Staff Assumptions in FEIS Analysis

A. Barging and Navigation

Q6. In the FEIS, did the NRC staff assume that heavy components would be delivered to the VEGP site by the use of barges on the Savannah River? If so, what was the basis for this assumption?

A6. (LWV, CBC) Yes. In the DEIS at pages 4-8, 4-16, and 4-25, the Staff mentioned Southern’s plans for dredging the barge slip adjacent to the VEGP site. Given that Southern planned to refurbish and dredge the barge slip, it was reasonable to assume that it expected to use the barge slip to bring items to the site that might not be easily transported by conventional transport (e.g. roads or rail). Consistent with the DEIS, the FEIS identified and evaluated that dredging of the barge slip area as one of the construction impacts. Exhibit NRC000001 at pages 4-8, 4-9, 4-17, 4-26 through 4-27, and 4-37. Additionally, based on comments on the DEIS from the public and from Federal and state resource agencies, the Staff identified and

evaluated the possible impacts of dredging the Federal navigation channel in the FEIS. Exhibit NRC000001 at pages 4-9 and 7-20.

Q7. Did the Staff in the FEIS discuss upstream reservoir operations in relation to support for navigation on the Savannah River?

A7. (LWV, CBC) No. The Staff assumed reservoir operations would not be altered solely for the purpose of navigation. The Staff assumed, based on informal discussions with members of the U.S. Army Corps of Engineers (“USACE” or “Corps”), that navigation would be feasible, at least during high flows on the Savannah River, without dredging of the Federal navigation channel. The Staff assumed that these high flows would occur in response to the Corps’ flood control rule curve, which is the policy that specifies the releases from the reservoir to ensure that the safety of the dam structure is not compromised by overtopping. The Staff assumed that the high flows resulting from implementation of the flood control rule curve would not, therefore, alter the conservation pools. Consistent with the above assumptions, the Staff would not expect that barging would occur until the current drought had ended and the reservoirs had sufficiently refilled to result in high flows without compromising the conservation pools. Accordingly the Staff did not consider it reasonably foreseeable that there would be impacts to the upstream reservoirs associated with releases for navigation, in connection with either the NRC’s action or the potential dredging of the Federal navigation channel.

Q8. How does the testimony of the Corps witnesses in this proceeding relate to that assumption?

A8. (LWV, CBC) The Staff considers the Corps testimony in this proceeding to be consistent with the Staff’s assumptions. The Corps witnesses state that “The USACE has made no study of minimum river flow needed to eliminate the need for dredging of the Savannah River Federal navigation channel or whether releases from upstream reservoirs could enable barge traffic to reach as far upstream as the Vogtle Electric Generating Plant. The region is presently experiencing a drought and excess water is not available in the lakes for such purposes.”

USACE Testimony at A15. Thus the Staff believes that upstream releases for navigation would not occur under drought conditions.

B. Potential Dredging of the Federal Navigation Channel

Q9. In the DEIS, did the Staff discuss a potential need for dredging the Savannah River Federal navigation channel as far upstream as the VEGP site?

A9. (LWV, CBC) Dredging of the Federal navigation channel was not mentioned in the DEIS, because it was not expected to occur based on informal Staff discussions with members of the Corps. This continued to be the opinion of the Staff at the time of the writing of the FEIS. However, based on comments to the DEIS, the Staff added an analysis in the FEIS regarding the potential dredging of the Federal navigation channel.

Q10. In preparing the DEIS, what assumptions (if any) did the Staff make regarding the need for dredging of the Federal navigation channel?

A10. (LWV, CBC) As mentioned in the response to Question 9, at the time of the preparation of the DEIS, the Staff did not believe that dredging for the Federal navigation channel was expected to occur. Moreover, the Staff did not assume that barging would be entirely infeasible without dredging nor that barging was the only possible transportation option for bringing components to the VEGP site. While road and rail transportation are other available options, the Staff evaluated the barging because this was the transportation option that was being contemplated by Southern in the ER.

Q11. Did those assumptions change between the issuance of the DEIS and the preparation of the FEIS?

A11. (LWV, CBC) No.

Q12. Did the Staff determine in the FEIS whether dredging of the Savannah River Federal navigation channel would be necessary for barge transportation of heavy components to the VEGP site?

A12. (LWV, CBC) In preparing the FEIS, the Staff expected that dredging was not essential to get large components to the VEGP site, even if barging were determined to be the only transportation option. Based on informal conversations with members of the Corps, the Staff believes that large components could be barged during periods of naturally occurring high flow. The Staff recognizes that this approach (i.e., having barging dependent on periods of high flow) could expose Southern to financial risk because of the inability to reliably predict naturally occurring periods of high flow, and thus could impact its desired construction schedule. However, the Staff does not consider such factors to be material to an ESP environmental review.

Q13. Were the Staff's assumptions regarding the need for dredging based on any specific communications with the applicant or with the USACE?

A13. (LWV, CBC, ARK, MDN) Yes. (MDN) In informal discussions with the Staff before and after the DEIS was issued, the applicant stated that the Corps had a mandate to maintain the Federal navigation channel. Also in informal discussions with the Staff occurring before and after the DEIS was issued, members of the Corps stated that while the Corps had authorization for maintaining the Federal navigation channel, the channel had not been maintained for several decades and Congress would need to provide funding before maintenance dredging could resume. Members of the Corps also stated to the Staff that the Corps had received no formal request from Southern regarding such dredging either by Southern or by the Corps.

(LWV, CBC) Based on informal discussions with members of the Corps following the publication of the DEIS, the Staff determined that it was unlikely that dredging of the Federal navigation channel would occur and certainly not within any short-term time frame. [ARK] This Staff view was also supported by the Staff's understanding of the Corps authorization and review process that would need to occur before dredging would begin. [LWV, CBC] Furthermore, members of the Corps did state in informal discussions with the Staff their view

that without dredging Southern could barge during high flow (flood) periods. Based on these considerations, the Staff determined that it was not implausible that Southern could move large components via barge during high flows.

Q14. Did the Staff assume that intentional releases of water from the upstream dams would be authorized to enable navigation and that those releases would be capable of providing adequate flows for barging regardless of whether or not dredging occurs?

A14. (LWV, CBC) No. As stated above in response to Question 12, the Staff assumed, based on informal discussions with the Corps before and after publication of the DEIS, that navigation would be feasible during high flows. The Staff assumed that these high flows would occur as a result of the Corps' implementation of the flood control rule curve, rather than being scheduled for the specific purpose of allowing barging.

Moreover, the testimony of Stanley L. Simpson of the USACE in this proceeding states that "[t]ransportation of large industrial components upstream by barge is not currently possible due to the shallow river depths. However, transportation of large components upstream by barge has occurred several times in the last 10 years. Shipment was made by Chem Nuclear of contaminated power plant reactor vessels to Barnwell, South Carolina (SC) for disposal. However, it required about a 10,000 cubic feet per second (cfs) discharge." USACE Testimony at A7. Mr. Simpson's testimony further notes that "from previous experience with nuclear waste shipments, it has required about 10,000 cfs discharge for more than one week to get a barge to Jackson, SC and back from Savannah Harbor." USACE Testimony at A15. The Staff considers that testimony to be consistent with the Staff's assumptions regarding the possibility of barging during high flow periods.

Q15. Did the Staff identify or assume a specific minimum flow at which dredging would not be necessary to enable barge traffic to the site?

A15. (LWV, CBC) No. The Staff believes this view is consistent with the Corps testimony in this proceeding. Moreover, the testimony of Stanley L. Simpson of the USACE in

this proceeding states that “The USACE has made no study of minimum river flow needed to eliminate the need for dredging of the Savannah River Federal navigation channel.” USACE Testimony at A15.

Q16. At the time of the preparation of the FEIS, had the Staff reviewed or become aware of any formal USACE plan for dredging or channel maintenance of the Federal navigation channel (or any formal request to the USACE for such a project)?

A16. (LWV, CBC) No. The Staff believes this view is confirmed by the Corps testimony in this proceeding. Moreover, the testimony of Lyle J. Maciejewski of the USACE in this proceeding responds “No” to the question of whether the Corps has developed a plan or received a formal request or authorization for dredging of the Savannah River Federal navigation channel in the near future to facilitate barge traffic as far north as the Vogtle Electric Generating Plant. USACE Testimony at A8.

Q17. At the time of the preparation of the FEIS, had the Staff reviewed or become aware of any formal USACE plan for intentionally releasing water from the upstream dams to provide adequate flows for barging?

A17. (LWV, CBC) No.

Q18. As of the date of this testimony, is the Staff aware of (or has the Staff reviewed) any such formal proposal pending before the Corps - whether proposed by the Corps or submitted to the Corps as an application by a private entity - for dredging of the Federal navigation channel or for intentionally releasing water from the upstream dams to provide adequate flows for barging?

A18. (LWV, CBC) No. The Staff believes this view is confirmed by the Corps testimony in this proceeding. The testimony of Lyle J. Maciejewski of the USACE in this proceeding responds “No” to the question of whether the Corps has developed a plan or received a formal request or authorization for dredging of the Savannah River Federal navigation channel in the near future to facilitate barge traffic as far north as the Vogtle Electric

Generating Plant. USACE Testimony at A8. The testimony of Carol L. Bernstein of the USACE also indicates that Southern has not indicated an intention to submit a permit application for dredging of the Federal navigation channel. USACE Testimony at A10.

C. Cumulative Impacts

Q19. Ultimately, did the Staff decide to include a discussion in the FEIS of the potential impacts of dredging the Federal navigation channel?

A19. (LWV/RHK) Yes. The Staff decided to include in the FEIS a discussion of the potential impacts of dredging the Federal navigation channel after receiving comments on the DEIS from the public and from Federal and state resource agencies. Some of these comments stated that the dredging of the Savannah River navigation channel would have major impacts or was not fully analyzed or considered. These comments are provided in Appendix E of the FEIS. Exhibit NRC000001 at E-55 to E-58, E-69, E-70, E-72 and E-73-74. The organizations that commented included the South Carolina Department of Natural Resources, the Georgia Department of Natural Resources, the U.S. Department of Interior, the U.S. Fish and Wildlife Service, the USACE, the Southern Alliance for Clean Energy, and the Nature Conservancy.

Q20. Where in the FEIS did the Staff analyze the potential impacts of dredging the Federal navigation channel?

A20. (RHK) The Staff analyzed the potential impacts in Chapter 7 – Cumulative Impacts. Exhibit NRC000001 at 7-20 and 7-21. The Staff determined this was the appropriate section for the discussion of dredging because the action of dredging the Federal navigation channel in the Savannah River is not under the NRC's jurisdiction and would require a separate review under the National Environmental Policy Act ("NEPA").

Q21. How does the NRC staff determine what actions to include in its discussion of cumulative impacts in Chapter 7 of the FEIS? And what steps are used in the review of cumulative impacts?

A21. (RHK, ARK) ESRP 4.7, "Cumulative Impacts Related to Construction Activities" (NRC 2007) "directs the staff's summarization of potential cumulative environmental impacts associated with construction activities for the proposed project." Exhibit NRC000010 at 4.7-1. The ESRP defines cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." This definition appears in the regulations of the Council on Environmental Quality (CEQ) implementing NEPA (40 CFR 1508.7). NRC regulations state that 40 CFR 1508.7 will be used by NRC in implementing NEPA. 10 CFR 51.14(b); Exhibit NRC000010 at 4.7-1.

According to the ESRP guidance, the evaluation of cumulative impacts is a three-step review. Exhibit NRC000010 at 4.7-3. The first step guides the Staff to identify past, present and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts with the proposed action. The second step involves identifying the geographic area to be considered in evaluating cumulative impacts (in this case the Savannah River at and below the VEGP site). The final step involves the identification and tabulation of the cumulative impacts.

As described in ESRP Section 4.7, CEQ guidance directs agencies to focus on cumulative impact information that is relevant to reasonably foreseeable significant adverse impacts, is essential to a reasoned choice among alternatives, and can be obtained without exorbitant cost. Exhibit NRC000010 at 4.7-3.

Q22. Why did the Staff analyze the potential dredging of the Federal navigation channel as a cumulative impact?

A22. (ARK, RHK) The dredging of the Federal navigation channel was, in the Staff's opinion, not required for the NRC's licensing action, since there are other ways to move the

large components to the VEGP site besides dredging the river (see the Staff response above to Question A10). In addition, the Staff did not assume that dredging would be necessary to allow barging, and it was the Staff's understanding that no formal request or permit application for dredging was before the Corps (see the Staff responses above to Questions A12 and A16). However, as a result of comments received on the DEIS, the Staff decided it was appropriate to consider dredging the Federal navigation channel as a potential future Federal action, even though the Staff did not believe it was certain to occur. Accordingly it was only discussed as a cumulative impact.

Q23. Why did the Staff not analyze in the FEIS any cumulative impacts to upstream reservoirs from intentionally releasing water from upstream dams?

A23. (LWV) As discussed in the response above to Question 7, the Staff did not believe there would be any alterations to the upstream reservoirs.

II. Staff Analysis of Potential Dredging Impacts

A. Assessment of Potential Impacts

Q24. Did the Staff identify in the FEIS the types of impacts to aquatic biota that might result from dredging of the Federal navigation channel?

A24. (ARK) Yes. In the FEIS at 7-20 the Staff concluded that dredging the Federal navigation channel in the Savannah River downstream of the VEGP site would likely have an effect on aquatic organisms for most trophic levels. These potential impacts could include: temporary loss of benthic habitat, disruption of spawning migrations, and resuspension of sediments that might be contaminated. In addition, the Staff mentioned that dredging would also require the disposal of dredged materials. Exhibit NRC000001 at 7-20.

Q25. Do you have professional experience in assessing the environmental impacts of such dredging projects?

A25. (ARK) Yes. From October 1987 until June 2006 I was a biologist with the Department of the Navy, Engineering Field Activity Northeast (EFANE), a former component of

the Naval Facilities Engineering Command, Atlantic Division, Lester, PA. EFANE performed engineering services for Naval Bases throughout the northeastern United States (U.S.). For almost 18 years, I served as the sole professional/technical authority at EFANE for the preparation and coordination of all Department of the Army permit applications, state wetland permit applications, and water quality certificate applications for activities in waters of the U.S. and navigable waters of the U.S. within the regulatory authority of Sections 401 and 404 of the Clean Water Act, Sections 9 and 10 of the Rivers and Harbors Act of 1899, and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972. In addition, I also assisted in the preparation of federal consistency determinations pursuant to Section 307 of the Coastal Zone Management Act and 15 CFR Part 930, Federal Consistency. As the Authorized Agent for Corps of Engineers Permits at EFANE, I had signatory authority for permit applications and attendant issues. I worked on very complex, controversial, and environmentally sensitive dredging projects during my EFANE tenure, which included the following locations: Naval Station Newport, RI; Naval Submarine Base New London, CT; the former Naval Station New York, Staten Island, NY; US Merchant Marine Academy, Kings Point, NY; Naval Weapons Station Earle, Leonardo, NJ; and the Naval Inactive Ship Maintenance Facility, Philadelphia, PA.

Q26. What was the Staff's basis for identifying the types of impacts discussed in the FEIS with respect to the potential dredging of the Savannah River Federal navigation channel?

A26. (ARK) Maintenance dredging involves the periodic removal of accumulated sediment (e.g., sand, silt, and clay) from a previously dredged area (e.g., navigation channel, harbor, marina) for the purpose of maintaining an authorized water depth and width for safe navigation. The general types of potential adverse environmental effects I have evaluated with previous dredging projects include: destruction of benthic habitat; disruption of spawning migrations, impairment of water quality, and the direct (e.g., toxicological) and indirect (e.g., habitat alteration) effects on fish and their prey species. It is reasonable to assume that the

regulatory and natural resource agencies responsible for reviewing a possible maintenance dredging project in the Savannah River Federal navigation channel would consider similar factors.

Maintenance dredging may result in adverse effects to benthic habitat either by direct removal of the benthic substrate by the dredging operation itself, or via disposal of the dredged material onto the benthic habitat at the disposal site. Various fish species can also lose a source of forage from removal of benthic macroinvertebrates within the dredged area. Sediment disturbance can also impact fish spawning, egg and larval development, and juvenile survivorship.

Water quality impacts from dredging and dredged material disposal include physical, chemical, and biological impacts. Physical impairment of the water column occurs from changes in dissolved oxygen, pH, oxidation-reduction state, and turbidity with a resultant decrease in light penetration. Chemical impairment is caused by release of various chemical contaminants that may occur within the sediment. Biological impairment can occur when introduction of dredged material into the water column kills submerged aquatic vegetation and macroalgae (either through direct smothering or via impaired light penetration) leading to higher rates of bacterial decomposition and a resultant increase in bacterial oxygen demand.

Due to my experience with very complex environmentally sensitive dredging projects in the northeastern U.S., I concluded that these considerations would also be potentially relevant to the analysis of maintenance dredging of the Savannah River Federal navigation channel.

Q27. What level of detail did the Staff use in its analysis of impacts to aquatic biota as a result of dredging the Federal navigation channel?

A27. (ARK, RHK) The Staff performed a qualitative impact analysis because it was the Staff's understanding that there was no formal request or permit application for maintenance dredging of the Federal navigation channel before the Corps (see Staff response above to Question 22). The qualitative analysis was based on the Staff's familiarity with previous

dredging projects and the fact that the Savannah River Federal navigation channel had previously been dredged.

Q28. Was this level of detail appropriate for the ESP FEIS? Why?

A28. (RHK, ARK) The qualitative nature of the review was appropriate for the ESP FEIS. As explained in the FEIS, the potential dredging project is incompletely defined, the amount of material that would be removed is unknown, and the locations of the dredged material disposal areas have not been identified. Exhibit NRC000001 at 7-20.

In addition, the Staff analysis in the FEIS emphasized that any dredging of the Federal navigation channel would require a separate NEPA process with a separate environmental review performed by the agency with the appropriate authority or jurisdiction, in this case the USACE. This review would be conducted at the time an actual project is formally requested or a permit application is submitted. The Corps in its environmental review presumably would be able to consider the specific details rather than trying to speculate about those details. For these reasons, the Staff determined that a qualitative review for the purposes of this FEIS was appropriate.

B. Basis for Staff Determinations

Q29. Did the Staff make a determination in the FEIS as to what the cumulative impacts to aquatic biota might be as a result of potential dredging of the Federal navigation channel?

A29. (ARK, RHK) Yes. In the FEIS, the Staff concluded that “the cumulative impacts to aquatic organisms in the region from the construction including dredging of a navigation channel could be MODERATE, depending on the type of mitigation.” Exhibit NRC000001 at 7-20. However, in reaching that conclusion, the Staff explained that “these impacts would be evaluated in more detail in the NEPA analysis that would need to be conducted by the USACE.” Exhibit NRC000001 at 7-21.

Q30. What was the basis for the determination that cumulative impacts to aquatic organisms in the region could be MODERATE depending on the type of mitigation?

A30. (ARK, RHK) The Staff determined that if the Corps were to pursue maintenance dredging of the Savannah River Federal navigation channel, the Corps would conduct its own NEPA review of that action. This review would likely include the preparation of either an Environmental Assessment (EA) or Environmental Impact Statement (EIS) in order to maintain the authorized navigation channel depth and width and manage the dredged material in a cost-effective, environmentally acceptable, and, wherever possible, beneficial manner. In the Staff's view, as a result of this anticipated Corps' review process, appropriate and practicable steps would be taken to minimize potential adverse impacts of the dredging and dredged material disposal on the aquatic ecosystem. The testimony of William G. Bailey of the USACE confirms that the Corps "...would prepare an environmental assessment of the proposed action...The process would conclude with either an Environmental Assessment (with a Finding of No Significant Impact) or an Environmental Impact Statement (with a Record of Decision)." USACE Testimony at A9.

It is the Staff's understanding that, as part of that environmental review, the Corps would conduct consultations with the Federal resource agencies, including the U.S. Fish and Wildlife Service ("USFWS") and National Marine Fisheries Service ("NMFS"), and would coordinate with the State regulatory and resource agencies where the dredging and dredged material disposal would occur. The agencies would work together to identify the biota at risk and determine the time of the year the areas proposed for maintenance dredging would be used by important species (e.g., birds, fish, macroinvertebrates) for breeding, foraging, rearing, or migration. Because of these Federal and state consultations, the Staff anticipates that the Corps would likely be required to avoid dredging activities during peak reproductive and migratory activities, and seasonal restrictions (or environmental windows) would be established by the Federal and state resource agencies for the project.

The testimony of the Corps witnesses is consistent with the Staff's understanding of this process. The testimony of William G. Bailey and Carol L. Bernstein describes the Corps'

process for an environmental review including consultation with other Federal and state agencies. USACE Testimony at A10 and A12. Their testimony also confirms the possibility of “special requirements/conditions for the dredging activities” including time-of-year restrictions. USACE Testimony at A11. The testimony of William G. Bailey also acknowledges that a coastal zone consistency certification may be required. USACE Testimony at A19.

The Staff understands that Section 401 of the Clean Water Act would require that maintenance dredging of the Savannah River Federal navigation channel comply with applicable State water quality standards authorized pursuant to Section 404 of the Clean Water Act. The states of both Georgia and South Carolina would likely require implementation of a water quality monitoring plan, and violation of state water quality standards would not be permitted to occur beyond a designated mixing zone. The testimony of William G. Bailey and Carol L. Bernstein confirms the need to obtain clearances under the Clean Water Act. USACE Testimony at A9 and A10.

The Staff acknowledged in the FEIS that “at the present time the dredging project is incompletely defined, the amount of material to be removed is unknown, and the locations of the dredged material disposal areas have not been identified.” Exhibit NRC000001 at 7-20. The testimony of Lyle J. Maciejewski states that “[t]he USACE does not currently know how much sediment would need to be removed, the nature of those materials, or where they could be deposited.” USACE Testimony at A17. The testimony of William G. Bailey states that “[t]he USACE has not sampled sediments in the Savannah River Federal navigation channel and can not accurately predict what contaminants may be present in those sediments.” USACE Testimony at A21.

Nevertheless, the Staff performed a qualitative review and concluded that cumulative impacts to aquatic organisms in the region from the construction, including dredging of a navigation channel, could be MODERATE, defined as “environmental effects [being] sufficient to alter noticeably, but not to destabilize, important attributes of the resource.” Exhibit NRC000001

at 1-4 and 7-20. The Staff anticipated that the Federal and state regulatory and resource agencies responsible for reviewing the dredging project would require project-specific mitigation measures to ensure that the cumulative impacts to aquatic organisms in the region would not be LARGE, defined as clearly noticeable environmental effects that would be sufficient to destabilize important attributes of the resource.

Q31. Does the Staff still consider the bases for the Staff's analysis and determination to be reasonable?

A31. (ARK) Yes. The Staff believes that the Staff's assumptions and approach are supported by the Corps testimony in this proceeding. First, the testimony of William G. Bailey acknowledges that if a project is eventually proposed, the Corps would conduct an environmental review in accordance with the US Army *Planning Guidance Notebook* (ER 1105-2-100) and the US Army *Procedures for Implementing NEPA* (ER 200-2-2). Exhibit NRC000048; Exhibit NRC000049; USACE Testimony at A12. As stated in his testimony, the Corps' environmental review document would identify the dredging that would be performed, the locations where the sediment would be deposited, and the environmental impacts of those actions. USACE Testimony at A9. The Corps would coordinate the document with the public and natural resource agencies and conclude with a Finding of No Significant Impact (FONSI) or a Record of Decision (ROD). *Id.* at A9. Through this coordination process, the Corps "would hope to obtain clearances under NEPA, the National Historic Preservation Act, the Coastal Zone Management Act, the Magnuson Fishery Conservation and Management Act, the Endangered Species Act, the Clean Water Act, and the Clean Air Act." *Id.* at A9.

As mentioned earlier in my testimony, the testimony of William G. Bailey and Carol L. Bernstein also acknowledges that "[s]pecial requirements/conditions for the dredging activities would likely result if a review of the project scope warrants such action." *Id.* at A11. In addition, their testimony states that "coordination with other federal and state agencies may result in a determination that time-of-year restrictions would be required in order to prevent impacts to

threatened and endangered species or aquatic resources.” *Id.* at A11. This description of the Corps’ environmental review process is consistent with the Staff’s conclusion in the FEIS that environmental impacts would be evaluated in more detail in the Corps’ NEPA analysis. Exhibit NRC000001 at 7-21.

The testimony of Lyle J. Maciejewski also verifies that the Corps has neither developed a plan nor received a formal request or authorization for dredging of the Savannah River Federal navigation channel in the near future to facilitate barge traffic as far north as the VEGP site. USACE Testimony at A8. His testimony explains that there are no funds currently available in the budget for either dredging the Savannah River Federal navigation channel or for conducting the environmental scoping, review, and documentation that would be necessary prior to the start of any dredging project. *Id.* at A14. In my view, this description of the Corps’ understanding of the current absence of any formal action to dredge the Federal navigation channel is consistent with the Staff’s assumptions in the FEIS.

Q32. Did the Staff assume that mitigating actions would be taken as part of any future dredging action, and what kinds of mitigating actions did the Staff consider to be possible or likely?

A32. (ARK) Yes, in the FEIS, the Staff discussed potential mitigation measures. In my experience, these mitigative measures, including the use of best management practices, time-of-year restrictions, relocation of benthic organisms, and restrictions on equipment types, are fairly standard and routine measures for dredging projects. Exhibit NRC000001 at 7-20. They were provided in the FEIS as examples only and not as specific recommendations for mitigative measures because there was (and is) no formal request or permit application to dredge the Federal navigation channel before the Corps for its review. See USACE Testimony at A8. The Staff indicated in the FEIS that “Specifics of the project including any time-of-year restrictions or mitigation to protect aquatic resources would be provided in the Corps’ assessment to fulfill the NEPA requirement.” Exhibit NRC000001 at 4-27.

The Staff also considers it likely that the Corps would conduct an evaluation of the physical, chemical, and biological characteristics of the sediment proposed for dredging in order to determine the dredging methodology (e.g., mechanical versus hydraulic) and dredged material disposal options and locations. But as stated in the FEIS, “[a]t the present time the dredging project is incompletely defined, the amount of material to be removed is unknown, and the locations of the dredged material disposal areas have not been identified.” Exhibit NRC000001 at 7-20. The testimony of Lyle J. Maciejewski confirms that the Corps does not currently know how much sediment would need to be removed, the nature of those materials, or where they could be deposited. USACE Testimony at A17. Without this information the Staff was not able to address the impacts of sediment disposal more specifically without entering into undue speculation.

The Staff anticipated that if dredging were conducted, by employing best management practices, impacts to water quality would be minimized and the water quality of the Savannah River would return to pre-project conditions. In my experience, some examples of best management practices to control sediment resuspension and downriver transport of resuspended sediments include selection of the proper dredge type and/or size, use of a sealed or environmental bucket for mechanical dredging, deployment of silt curtain containments, use of sheet pile enclosures, management of barge overflow, and control of sediment loss from bucket to barge as well as from the barge to the upland offloading location.

The Staff also considered that time-of-year restrictions on dredging operations would reduce water quality impacts (including physical, chemical, and biological impairment) due to dredging operations during migration, breeding, and early life history stages of sensitive aquatic species. The testimony of William G. Bailey and Carol L. Bernstein has noted that “[s]pecial requirements/conditions for the dredging activities would likely result if a review of the project scope warrants such action.” USACE Testimony at A11.

Finally, the Staff considered the concerns expressed in comments on the DEIS from members of the public and from Federal and state resource agencies regarding the potential impacts that dredging of the Savannah River Federal navigation channel would have on aquatic resources (e.g., freshwater mussels). These comments are provided in Appendix E of the FEIS. Exhibit NRC000001 at E-56, E-57, E-69, E-71 to E-73 and E-76. The Staff anticipated that if such a dredging action were to occur, the Corps' environmental review process (including consultation with other Federal and state agencies) would consider impact avoidance, but would then consider minimization with, ultimately, mitigative actions to preserve the threatened, endangered, and sensitive mussel species that occur in the Savannah River. In the Staff's view, if avoidance of the freshwater mussels during future dredging of the Federal navigation channel were deemed to be infeasible by the Corps based on its review, then, as stated in the FEIS, in combination with other mitigative measures described above, relocation of benthic organisms could ameliorate many of the impacts. Exhibit NRC000001 at 7-20.

The types of project-specific mitigation required by the regulatory and resource agencies might involve sediment testing and analyses, dredge plume modeling, pre-and post-dredge biological surveys, mussel relocation and survival monitoring. Dredging operations could be limited to a few months each year or restricted to certain times of the day, limitations could be imposed on size and type of dredge and disposal equipment used, and special requirements/monitoring could be required at the dredged material disposal locations. Based upon my personal experiences, these special mitigation efforts have been successfully implemented elsewhere to minimize impacts to biological resources.

Q33. Why did the Staff ultimately conclude that the cumulative impacts to aquatic organisms in the region could be MODERATE rather than another impact level?

A33. (ARK) After considering the potential types of impacts, likely mitigation measures and the Corps' review process as discussed above, the Staff ultimately concluded that the cumulative impacts to aquatic organisms in the region could be MODERATE. This

impact level is defined as “environmental effects [being] sufficient to alter noticeably, but not to destabilize, important attributes of the resource.” The considerations discussed above support the finding of MODERATE.

Pursuant to Title 33 CFR 335, Operation and Maintenance of Army Corps of Engineers Civil Works Project Involving the Discharge of Dredged or Fill Material into Water of the U.S. or Ocean Waters, Section 335.2 Authority, “the Corps does not issue itself a CWA [Clean Water Act] permit to authorize Corps discharges of dredged material or fill material into U.S. waters, but does apply the 404(b)(1) guidelines and other substantive requirements of the CWA and other environmental laws.” These Guidelines, prepared by the US Environmental Protection Agency in consultation with the Corps, are the Federal environmental regulations for evaluating the filling of waters and wetlands.

As defined at 40 CFR 230.1(a), “The purpose of these Guidelines is to restore and maintain the chemical, physical, and biological integrity of waters of the United States through the control of discharges of dredged or fill material.” Compliance with the Guidelines at Subpart B, 40 CFR 230.10 (a) through (d), prohibits discharges under various circumstances, including: (a) “...if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences...” [also known as Least Environmentally Damaging Practicable Alternative (LEDPA)]; (b) if the action causes or contributes to violations of any applicable State water quality standard, violates any applicable toxic effluent standard or prohibition under section 307 of the Act, the Endangered Species Act, or Marine Protection, Research, and Sanctuaries Act; (c) if the action “...will cause or contribute to significant degradation of waters of the US...”; and (d) “... unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem...” It should be noted that the goal of the Section 404(b)(1) Guidelines is to provide a framework for arriving at the LEDPA.

Appendix C of the US Army *Planning Guidance Notebook* (ER 1105-2-100) addresses the integration of environmental evaluation and compliance requirements into the planning of Civil Works projects. In particular, Exhibit C-1 provides a recommended outline for completing a Section 404(b)(1) evaluation. Exhibit NRC000048 at C-48 to C-55. The testimony of William G. Bailey acknowledges that if a Federal project is eventually proposed, the Corps would conduct an environmental review in accordance with ER 1105-2-100. USACE Testimony at A12.

It is the Staff's understanding that in order for the Corps to complete its NEPA analysis, the project must be in compliance with the CWA Section 404(b)(1) Guidelines. The testimony of Carol L. Bernstein notes that if the Corps were to receive a permit application from Southern, the Corps would also evaluate the dredging project with respect to Section 404(b)(1) analysis, 31 public interest factors, and cumulative impacts. USACE Testimony at A10. It is the Staff's understanding that these criteria would constrain the potential impacts of maintenance dredging of the Savannah River Federal navigation channel, were such a project to be undertaken. In the Staff's opinion, if a potential dredging project for the Federal navigation channel were to comply with these standards, it would not result in a cumulative impact of LARGE, which is defined as "environmental effects [being] clearly noticeable and [being] sufficient to destabilize important attributes of the resource." For that reason, I consider it unlikely that a dredging project that would destabilize the Savannah River would obtain the necessary approvals from the Federal and state regulatory agencies. Accordingly, the Staff determined that cumulative impacts from construction of Vogle Units 3 and 4 including dredging of the Federal navigation channel could be MODERATE, depending on the type of mitigation. Exhibit NRC000001 at 1-4 and 7-20.

Q34. Does this conclude your testimony?

A34. (ALL) Yes.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
SOUTHERN NUCLEAR OPERATING CO.) Docket No. 52-011-ESP
)
(Early Site Permit for Vogtle ESP Site))

AFFIDAVIT OF ANNE R. KUNTZLEMAN CONCERNING
PREFILED TESTIMONY ON ENVIRONMENTAL CONTENTIONS 1.2 AND 6.0

I, Anne R. Kuntzleman, do declare under penalty of perjury that my statements in *NRC Staff Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.2*, and in *NRC Staff Testimony of Mark D. Notich, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 6.0*, as well as in my attached statement of professional qualifications are true and correct to the best of my knowledge, information, and belief.

**Executed in Accord with
10 C.F.R. § 2.304(d)**

Anne R. Kuntzleman

Executed at Rockville, Maryland
This 9th day of January, 2009

Anne "Nancy" R. Kuntzleman
STATEMENT OF PROFESSIONAL QUALIFICATIONS
UNITED STATES NUCLEAR REGULATORY COMMISSION
Washington, D.C.

I am currently employed as an aquatic biologist in the Office of New Reactors, Division of Site and Environmental Reviews, Environmental Technical Support Branch, U.S. Nuclear Regulatory Commission. As an NRC staff member, I am responsible for conducting the aquatic and terrestrial technical reviews associated with the preparation of an environmental impact statement (EIS) for siting, construction, and operation new nuclear power plants.

I hold a Bachelor of Science in Biology from the Pennsylvania State University (1975), a Master of Science in Education from Temple University (1981), and a Master of Science in Biology from the University of Michigan (1982). I have also pursued graduate studies in biology at the University of Maryland (1980) and the University of Pennsylvania (1985).

From July 1975 through August 1986, I was an aquatic ecologist for two environmental consulting firms (Ichthyological Associates and Radiation Management Corporation, respectively) under contract to Philadelphia Electric Company. I assisted in all phases (field work, data processing, data analyses, report writing) of both aquatic and terrestrial preoperational studies at the Limerick Generating Station (LGS), Limerick Township, PA. My duties during this time included assisting in the age and growth survey of redbreast sunfish (*Lepomis auritus*), green sunfish (*Lepomis cyanellus*), and white sucker (*Catostomus commersonii*) from the East Branch Perkiomen Creek and the Schuylkill River in the vicinity of LGS by participating in field sampling with a small stream shocker and performing fish scale removal, pressing, and reading. I also participated in field work to conduct fish population estimates along the Schuylkill River via electrofishing, fish community characterizations via seine in the Perkiomen Creek, and angler surveys along the East Branch Perkiomen Creek and Schuylkill River in conjunction with the pre-operational monitoring program at LGS. Assisted in writing the procedures for collecting plant, mammal, sediment, and fish samples in conjunction with the Radiological Environmental Monitoring Program (REMP) at LGS and was responsible for coordinating the collection of the REMP sediment, vegetation, and fish samples.

In addition, from August 1975 through December 1976, I supervised two fishery biologists and two fishery technicians during the field work performed for two Clean Water Act (CWA) Section 316(a) thermal plume investigations on the Schuylkill River: Schuylkill Generating Station (SGS), Philadelphia, PA, and Cromby Generating Station (CGS), Phoenixville, PA, respectively. Field work included electrofishing, larval fish tows, Ponar grabs for benthic macroinvertebrates, plankton sampling, thermal plume mapping, and collection of physical chemistry data. I sorted, identified, measured, and processed both adult and larval fish collections. I assisted in report writing, data coding, and editing. I conducted a thorough non-parametric statistical analysis of both the catch per effort and larval fish data for SGS. Our electrofishing efforts at the base of Fairmount Dam in Philadelphia documented the presence of American shad (*Alosa sapidissima*). This finding assisted the Pennsylvania Fish Commission in justifying construction of the Fairmount Dam Fish ladder in 1979.

During the late 1970's I was also a field biologist for CWA Section 316(b) cooling water intake studies (impingement of fish and macroinvertebrates and entrainment of plankton, macroinvertebrates, and larval fish) at four freshwater and seven estuarine steam electric power stations on the Schuylkill and Delaware Rivers, respectively. I sorted, identified, measured, and processed the impingement and larval fish collections. I assisted in the preparation of the 316(b) evaluations for CGS and SGS located on the Schuylkill River and the Eddystone Generating Station and Edge Moor Power Station on the Delaware River.

Later as an environmental educator, I developed and presented aquatic ecology and fish identification in-service training programs for elementary and secondary schoolteachers within the Philadelphia Electric service area. I also presented lectures to community groups, environmental organizations, and students explaining the environmental preoperational studies and monitoring requirements for LGS.

From September 1986 until September 1987 I taught life science and physical science at Northeast Junior High School, Reading, PA.

From October 1987 until June 2006, I was a senior biologist with the Department of the Navy, Engineering Field Activity Northeast (EFANE), a component of the Naval Facilities Engineering Command, Atlantic Division. For almost 18 years, I served as the sole professional/technical authority for EFANE in the preparation and coordination of all Department of the Army permit applications, Coast Guard permits, state wetland permits, and water quality certificates for activities in waters of the United States (U.S.) and navigable waters of the U.S. within the regulatory authority of Sections 401 and 404 of the Clean Water Act (CWA), Sections 9 and 10 of the Rivers and Harbors Act of 1899, and Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972. In addition, I also prepared federal consistency determinations pursuant to Section 307 of the Coastal Zone Management Act and Volume 15 of the Code of Federal Regulations, Part 930, Federal Consistency.

During my tenure at EFANE, I had signatory authority for permit applications and attendant issues involving some of the Navy's most complex, controversial, and environmentally sensitive projects in the northeastern U.S.: dredging and dredged material disposal, waterfront construction, and new construction in or adjacent to wetlands.

Concomitant with regulatory requirements, I prepared or evaluated environmental documentation or analyses (prepared by Navy contractors) conducted under the National Environmental Policy Act (NEPA), Section 7 of the Endangered Species Act (ESA), the Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat Assessment), Marine Mammal Protection Act, Fish and Wildlife Coordination Act, Executive Order 11988 (Floodplain Management), Executive Order 11990 (Protection of Wetlands), and Executive Order 13112 (Invasive Species).

As the Navy technical representative, I developed scopes of work, prepared independent cost estimates, analyzed contractor proposals, participated in negotiations, and developed contract execution schedules for Navy contractors. I provided technical oversight of contractor's work, monitored work in progress, and evaluated contractor's performance. I reviewed technical

submissions for accuracy and interpreted biological, chemical, and other environmental test results during contractor preparation of a variety of environmental documents including: NEPA environmental assessments and EISs, essential fish habitat assessments, coastal zone consistency determinations, 401 water quality certification applications, sediment sampling and testing plans for dredging projects, wetland delineations, wetland restoration plans, CERCLA remedial action plans, and integrated natural resources management plans.

In June 2006, I joined the Nuclear Regulatory Commission as an aquatic biologist. I serve as a technical specialist whose primary responsibility is that of independently assessing the environmental impacts of siting, construction, and operation of new nuclear power plants and related facilities on the aquatic environment. This involves reviewing and evaluating specific aspects of Environmental Reports submitted to the NRC by applicants and licensees and then assisting in the preparation an EIS. My duties also include updating the NRC environmental standard review plans for aquatic ecology contained in NUREG-1555, preparing biological assessments for Federal threatened and endangered species, and coordinating with federal and/or state agencies pursuant to NEPA, ESA, Sections 401 and 404 of the CWA, Section 10 of the Rivers and Harbors Act of 1899, Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat Assessment), Marine Mammal Protection Act, and Fish and Wildlife Coordination Act.

Thus far I have participated in pre-application activities for the Bell Bend, North Anna, Shearon Harris, William States Lee, Vogtle, River Bend, South Texas Project, Comanche Peak, and Callaway combined license (COL) applications. I have conducted the aquatic and terrestrial acceptance reviews for the Shearon Harris, William States Lee, and Callaway COL applications. In addition, I have participated in site audits and alternative site visits for the Vogtle Early Site Permit (ESP) as well as the William States Lee and Shearon Harris COL applications. I have provided technical oversight for the aquatic and terrestrial sections of the Vogtle ESP draft and final EISs.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
SOUTHERN NUCLEAR OPERATING CO.) Docket No. 52-011-ESP
)
(Early Site Permit for Vogtle ESP Site))

AFFIDAVIT OF LANCE W. VAIL CONCERNING
PREFILED TESTIMONY ON ENVIRONMENTAL CONTENTIONS 1.2, 1.3 AND 6.0

I, Lance W. Vail, do declare under penalty of perjury that my statements in *NRC Staff Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.2*, in *NRC Staff Testimony of Dr. Michael T. Masnik, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.3*, and in *NRC Staff Testimony of Mark D. Notich, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 6.0*, as well as in my attached statement of professional qualifications are true and correct to the best of my knowledge, information, and belief.

**Executed in Accord with
10 C.F.R. § 2.304(d)**

Lance W. Vail

Executed at Richland, Washington
This 9th day of January, 2009

STATEMENT OF PROFESSIONAL QUALIFICATIONS OF LANCE W. VAIL

CURRENT POSITION

Senior Research Engineer II
Environmental Technology Division
Battelle, Pacific Northwest Division
Pacific Northwest National Laboratory

Since joining Battelle in 1981, Mr. Vail has been involved in projects covering a diverse set of water related issues. His professional experience includes basic and applied research, and regulatory compliance assessments. His areas of expertise cover a broad spectrum of areas related to water resources.

RESEARCH INTERESTS

Water resource management
Multiple objective tradeoff analysis in water resources
Uncertainty analysis in water resources
Advanced hydrologic process modeling
Impacts of climate on water resources
Neural networks, fuzzy logic, and genetic algorithms applied to water resource issues
Linking simulation models with optimization methods to water resource problems
Linkage of physical and biological models in fisheries management

EDUCATION

B.S.	Humboldt State University, environmental resources engineering	1979
M.S.	Montana State University, civil engineering	1982

PROFESSIONAL AFFILIATIONS

American Geophysical Union
American Society of Civil Engineers
American Water Resources Association

CURRENT PROJECTS

Hydrologic Site Safety Reviews for Early Site Permits. Principal Investigator and Project Manager. Three applications for an Early Site Permit (ESP) have been submitted to the Nuclear Regulatory Commission. This project provides an independent assessment of hydrologic suitability of the proposed sites. Assessments include a broad range of considerations such as flooding, low water conditions, ice impacts, seiches, storm surge, and tsunamis.

Water-related Environmental Reviews for Early Site Permits. Task Manager. Three applications for an Early Site Permit (ESP) have been submitted to the Nuclear Regulatory Commission. This task provides an independent assessment of the proposed sites' environmental suitability. Assessments include a broad range of considerations such as water-use conflicts and changes in water quality.

Snohomish Basin Characterization. Technical Lead. Advanced distributed watershed models were applied to provide the Tulalip Tribes of Western Washington state a thorough understanding of the impacts of logging, development, and climate on the Snohomish River Basin.

Acid Rain TMDL. Principal Investigator and Technical Project Manager. The objective of this work assignment for Region II of the U.S. Environmental Protection Agency is to develop a preliminary assessment approach for TMDLs

for pH impaired waters listed on the New York State Section 303(d) list. The intent is to enhance and further develop TMDL program capabilities by providing expertise in both acid deposition and TMDL development. The development of such an assessment approach requires that available models and data resources be reviewed. Systems engineering methods will be used in developing a conceptual model to ensure the relationships between models and data are fully understood. The assessment approach will be tested on one or more representative watersheds to be determined in close coordination with EPA, NYSDEC and Battelle. <http://acidraintmdl.pnl.gov>

PAST PROJECTS

Environmental Impact of License Renewal of Commercial Nuclear Power Plants. Contributor. Mr. Vail assesses the water use, water quality, and hydrologic impacts of license renewal for the Nuclear Regulatory Commission's NEPA process. He has performed this function for the following commercial nuclear plants: Calvert Cliffs, Oconee, Arkansas Nuclear One, Hatch, McGuire, Catawba, North Anna, Robinson, Ginna, and St. Lucie.

Chehalis Basin Characterization. Principal Investigator and Project Manager. Advanced numerical modeling and GIS methods were applied to assist the Corps of Engineers in characterizing the Chehalis Basin in Western Washington State. The Chehalis Basin is subject to frequent flooding. The native populations of anadromous fish have been stressed to adverse changes in habitat resulting from development and logging.

Generic Environmental Impact Statement (GEIS) for Decommissioning Commercial Nuclear Power Plants. Contributor. Mr. Vail is providing expertise in the development of a GEIS for decommissioning of nuclear plants. He provides expertise on water use, water quality, and hydrologic impacts for the Nuclear Regulatory Commission.

Impact of Climate on the Lower Yakima Basin. Principal Investigator and Project Manager. The objective of this three-year EPA STAR Grant Project was to develop and demonstrate an integrated assessment of the impact of climate variability and climate change on a diverse set of interests in the Lower Yakima Valley in Central Washington State. Interests considered include: surface and groundwater supply, surface and groundwater quality, air quality, public health, farm and regional economics, and fisheries. The project considered the effectiveness of changes in land management (crop selection) and water management (reservoir operation) in adapting to an uncertain future climate. A diverse set of models was linked with an optimization procedure to ensure that the tradeoffs between various resource management objectives are clearly articulated. <http://projects.battelle.org/yakima/>

Use of NOAA's Seasonal Climate Forecast for Water Resource Management. Task Manager of Reservoir Optimization Task. The objective of this NOAA funded project was to show the potential value of improved climate forecasts in managing surface water reservoirs for multiple objectives. Using a pareto genetic algorithm, the reservoir operating rules were optimized to define the tradeoff curves for hydropower, flood control, and instream flow requirements in the Tennessee River basin. Changes in forecast reliability result in changes to these tradeoffs and thereby express the value of such improved forecasts.

Accelerated Climate Prediction Initiative. Task Manager of Water Resources and Habitat Task. This project will provide a limited, systematic assessment of the potential effects of anthropogenic climate change over the next half-century on water resources in the western United States. This objective was accomplished by "downscaling" the results of the global-scale simulations described above to the spatial and temporal resolution needed to drive impact assessment models. Downscaling is particularly important for the West, where topography is a dominant climate driver. An important aspect of the hydrology of almost all western rivers is water management. Other than a few headwater streams, the hydrology of most rivers in the west is strongly affected by water use and artificial storage. Water management models were

used to study the effect of reservoir operations and understand the implications of climate variability and change on the water resources of the west. <http://acpiwater.pnl.gov>

Linking Physical and Biological Models. Principal Investigator and Project Manager. The objective of this three-year Laboratory Directed Research and Development project is to develop and demonstrate an integrated natural resource analysis framework. This framework: dramatically improves the ability to integrate physical and biological models, thereby encouraging the utilization of advanced process models; allows utilization of large, sparse, and distributed data sets (including model output); communicates high-level tradeoffs and their respective uncertainties; and assesses, communicates, and minimizes scales issues. During the first year, the fundamental structural differences between such models was identified as a significant obstacle to successful linking of physical and biological models. The pervasive vagueness of rules and the multivaluedness associated with temporal/spatial upscaling suggested an approach using “fuzzy methods”. The second year of this project utilized a variety of fuzzy methods including: fuzzy arithmetic, fuzzy logic, fuzzy clustering, and adaptive neural fuzzy inference systems (ANFIS). A series of rules and a database from the Multispecies Framework Process were employed to test the various fuzzy methods. These rules and data are used to define aquatic habitat diversity in the Pacific Northwest. A tool called FuzzyHab was developed to estimate habitat diversity from a set of categorical statements about the environment. Each of these categorical statements is vaguely defined. Estimates for each categorical statement are derived from physical process models.

Integrated Natural Resource Data System. Contributor. This project is to demonstrate INRDS. INRDS is an advanced, web-based environmental information system that will promote public understanding of natural resource management issues and assist planners and decision makers in accessing the most relevant information and analytical tools and evaluating the tradeoffs of alternate actions. <http://inrds.pnl.gov>

Early Warning of El Niño Southern Oscillation (ENSO) Events for Regional Agriculture. Task Manager of Reservoir Optimization Task. This project is investigating the current predictability of interannual variability in climate conditions in the Pacific Northwest to determine whether and how early warning and seasonal climate forecasts by the Climate Prediction Center (CPC) of the National Oceanic and Atmospheric Administration (NOAA) forecasts can be used to reduce the vulnerability of irrigated agriculture to low water-availability conditions. The study is funded by a grant from the economics and Human Dimensions Program of the NOAA Office of Global Programs. The Economics and Human Dimensions program aims to improve our understanding of how social and economic systems are currently influenced by fluctuations in short-term climate (seasons to years), and how human behavior can be (or why it may not be) affected based on information about variability in the climate system. <http://elrino-northwest.labworks.org>

Impact of Reservoir Operating Strategies on Resident Fish - Mr. Vail has employed several models to assess the impact on resident fish species of a variety of reservoir operating strategies. This study was undertaken as part of the Columbia Basin System Operation Review process. Mr. Vail helped define the values and value measures of the Resident Fish Work Group.

Multiobjective Optimization - Mr. Vail is the project manager of an effort to assess the multiobjective optimization needs of Bonneville Power Administration. Objectives include: hydropower, resident fish, anadromous fish, irrigation, flood control, wildlife, and navigation. Mr. Vail is developing definitions of the canonical mathematical form of each of these objectives. The resulting multiobjective statement will be used to define the required optimization tools.

Integrated Environmental Monitoring Initiative - Mr. Vail is a co-principal investigator for the Integrated Environmental Monitoring Initiative. The objective of this initiative is to develop and demonstrate a comprehensive interdisciplinary methodology targeted to improve the effectiveness of environmental monitoring and restoration activities. This objective required comprehensive integration of monitoring regimes, analytical practices, design methodologies, and compliance needs.

Coupled Simulation/Optimization of Ground Water Remediation - Mr. Vail developed a computer code that coupled a ground water flow model with an optimization procedure. The code was able to provide estimates of the pumping/injection rates that would mitigate or remove a plume at minimal cost.

Simulation of Watershed Hydrologic Responses to Alternative Climates - Mr. Vail is the principal investigator of a project studying the impacts of global climate change on the hydrologic response of a watershed. The results of hydrologic simulations using distributed snowmelt and soil moisture accounting algorithms were graphically compared via video displays of daily simulated snow water equivalent, soil moisture, and runoff for the American River, Washington, which drains 204 square kilometers of the east slopes of the Cascade Mountains, Washington. Snow water equivalents and snowmelt were simulated using a simplified distributed temperature-index model augmented with seasonally estimated net solar radiation. A classification scheme was used to partition the empirical cumulative probability distributions of precipitation (rain plus melt) and a topographic index over the basin into groups of near-equal membership. Topographically-based soil moisture capacities were assumed for each class and were estimated via automated calibration methods using historical data. The simulated soil moisture and snow water accumulations for each class were geographically mapped for visualization. Test of the effect of alternative, warmer climates on snow accumulation, the seasonal distribution of soil moisture, and runoff were conducted by adjusting historical (daily) temperature and precipitation and repeating the analysis.

Pacific Northwest Climate Change Case Study - Water Resource Impacts - Mr. Vail is investigating the effects of global climate change on water resources of the Pacific Northwest. Spatially distributed snowmelt, soil moisture, and runoff models have been combined with a graphics visualization package to understand the changes in snowpack, soil moisture, and evapotranspiration over time. A weather classification scheme has been developed which estimates point precipitation as a function of large-scale atmospheric variables. This allows the synthesis of point precipitation given large-scale meteorological information as might be produced by GCM simulations. Orographic effects also have a significant role in defining climate at the watershed scale. Efforts are under way to develop a scientific basis to extend the sparse meteorological measurements basis to extend the sparse meteorological measurements available for any watershed to estimate the spatial distribution of precipitation, temperature, and wind speed within the watershed. A reservoir network model for the Columbia River Basin has been aggregated to fourteen nodes. This network model of the Columbia River Basin has been aggregated to fourteen nodes. This network model will be driven by a collection of index watersheds. A daily hydroclimatological data set has been developed to aid in the selection of index watersheds.

Acid Rain Watershed Modeling Project - Mr. Vail directed the hydrologic part of a study to evaluate and apply several coupled hydrology/geochemical codes that were developed to model the impact of acid rain on surface water chemistry. The project involved extensive behavior and sensitivity analyses of three coupled geochemical/hydrological simulation codes.

Incineration at Sea - The objective of this project was to assess the impact of incinerating toxic waste at sea on the aquatic environment. Mr. Vail developed a model on an IBM-PC to estimate the concentration of contaminant in the ocean.

Aquifer Thermal Energy Storage - The objective of this project was to develop and apply computer codes that would simulate the trade-offs between different management policies of an Aquifer Thermal Energy Storage system. Mr. Vail independently developed, validated, and applied several computer codes for this purpose.

Flow and Fractured Media - The objective of this study is to develop a state-of-the-art predictive capability for flow and transport in saturated fractured media. Mr. Vail was responsible for implementing, modifying, and testing a computer code that models steady flow in permeable media with discrete fractures. Mr. Vail has also developed a computer code that models steady flow through fractures in an impermeable rock mass. The fractures can either be specified or generated via Monte Carlo Methods. This code was applied in an investigation of the potential impact of a nuclear meltdown on groundwater.

Modeling Flow With Certainty in Hydraulic Parameters - The objective of this study is to develop a methodology to analyze the uncertainty in predicting piezometric surfaces caused by uncertainty in groundwater flow parameters. Mr. Vail developed a computer code that couples perturbation and finite-element techniques to estimate the mean and variance of the piezometric surface.

Stripa Mine Hydrogeologic Characterization - The objective of this study was to perform three-dimensional simulations with the CFEST code for ground water flow at the Stripa Mine in Sweden. Mr. Vail was the Battelle project manager of this effort.

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
SOUTHERN NUCLEAR OPERATING CO.) Docket No. 52-011-ESP
)
(Early Site Permit for Vogtle ESP Site))

AFFIDAVIT OF MARK D. NOTICH CONCERNING PREFILED TESTIMONY
ON ENVIRONMENTAL CONTENTION EC 6.0 AND SPONSORING NUREG-1872

I, Mark D. Notich, do declare under penalty of perjury that my statements in *NRC Staff Testimony of Mark D. Notich, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 6.0* and in *Prefiled Direct Testimony of Mark D. Notich Sponsoring NUREG-1872 Into Hearing Record*, as well as in my attached statement of professional qualifications are true and correct to the best of my knowledge, information, and belief.

**Executed in Accord with
10 C.F.R. § 2.304(d)**

Mark D. Notich

Executed at Rockville, Maryland
This 9th day of January, 2009

Mark D. Notich
STATEMENT OF PROFESSIONAL QUALIFICATIONS
UNITED STATES NUCLEAR REGULATORY COMMISSION
Washington, D.C.

I am currently employed as a Senior Project Manager in the Office of New Reactors, U.S. Nuclear Regulatory Commission (NRC). I have been employed by the NRC since October 2005. I am currently assigned as the Environmental Project Manager for the development of the Environmental Impact Statement for the Early Site Permit (ESP) application for the Vogtle Electric Generating Plant (VEGP), submitted by Southern Nuclear Operating Company (SNC).

I hold a Bachelor of Science in Agricultural Chemistry from the University of Maryland (1978).

As the Environmental Project Manager for the Vogtle ESP, I have been deeply involved in all planning and management activities for pre-application activities, the acceptance review for the Plant Vogtle Environmental Report (ER), public meetings, meetings with State and federal agency stakeholders, site visits, review of SNC's ER, development of Requests for Additional Information (RAIs), and development and publication of the Draft and Final Environmental Impact Statements for the ESP. I also oversee the activities of the team specialists from Pacific Northwest National Laboratory (PNNL) and serve as the Technical Monitor for tracking the financial and technical progress of the contractor's task.

I have also supported the following NRC activities:

- Review of the Grand Gulf ESP and Clinton ESP Draft EISs by reviewing and commenting on assigned sections
- Review and comment on the Appendices for the North Anna ESP EIS
- Development of the format for the North Anna ESP Supplemental EIS
- Review and comment on the Historic and Cultural Resources section of the Vermont Yankee (VY) License Renewal Supplemental EIS (SEIS)
- Review of pre-application activities at the North Anna Plant and at the V.C. Summer Nuclear Power Station

Prior to joining the NRC, I served as a Senior Environmental Scientist for Advanced Technologies and Laboratories (ATL) International, Inc. from July 2000 to September 2005. I was the Deputy Project Manager/QA Manager for the Savannah River Dose Reconstruction Task for the Centers for Disease Control and Prevention (CDC) contract with responsibility for overseeing and managing the completion of project tasks, adherence to project schedules, and coordinating the preparation of the project's final report. I also served as Task Manager for the preparation of an Environmental Impact Statement for the Louisiana Energy Services Uranium Enrichment Facility in Hartsville, TN, supported the revision and updating of several NRC Regulatory Guides, and served as Task Manager for the development of an Environmental Assessment for the Re-

licensing of the General Electric- Morris Operation (GE-MO) Independent Spent Fuel Storage Installation (ISFSI) and a Generic Environmental Assessment for the Re-licensing of Wet and Dry Storage ISFSIs. I also supported the development of numerous Environmental Impact Statements for the U. S. Department of Energy (DOE) including the Programmatic EIS for the Disposition of Radioactively Contaminated Scrap Metal and the Hanford Site Solid Waste Environmental Impact Statement.

From May 1987 to June 2000, I was a Senior Environmental Scientist for Tetra Tech NUS. I supported the development of several Environmental Impact Statements including an EIS for ship breaking and recycling in the United States and a Preliminary Environmental Impact Statement (PEIS) for the U.S. Department of Defense's Strategic Defense Initiative's Ballistic Missile Defense Program and of the Spent Nuclear Fuel Environmental Impact Statement for DOE's Idaho National Environmental Engineering Laboratory. I also provided senior technical review for DOE's New Production Reactor Environmental Impact Statement.

From September 1978 to May 1987, I was a Senior Analytical Chemist and Project manager supporting numerous environmental analyses and assessment projects for Hittman Ebasco Associates, Inc.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
SOUTHERN NUCLEAR OPERATING CO.) Docket No. 52-011-ESP
)
(Early Site Permit for Vogtle ESP Site))

AFFIDAVIT OF MICHAEL T. MASNIK CONCERNING
PREFILED TESTIMONY ON ENVIRONMENTAL CONTENTIONS 1.2 AND 1.3

I, Michael T. Masnik, do declare under penalty of perjury that my statements in *NRC Staff Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.2*, and in *NRC Staff Testimony of Dr. Michael T. Masnik, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.3*, as well as in my attached statement of professional qualifications are true and correct to the best of my knowledge, information, and belief.

**Executed in Accord with
10 C.F.R. § 2.304(d)**

Michael T. Masnik

Executed at Rockville, Maryland
This 9th day of January, 2009

Michael T. Masnik
STATEMENT OF PROFESSIONAL QUALIFICATIONS
UNITED STATES NUCLEAR REGULATORY COMMISSION
Washington, D.C.

I am currently employed as a Senior Aquatic Ecologist in the Office of New Reactor Operations, U. S. Nuclear Regulatory Commission (NRC). As a senior member of the staff I am responsible for understanding and assessing the non-radiological impacts of nuclear power generation on a variety of aquatic environments.

I hold a Bachelor of Science in Conservation from Cornell University (1969), a Master of Science in Zoology from Virginia Polytechnic Institute and State University (1971), and a Doctor of Philosophy in Zoology also from Virginia Polytechnic Institute and State University (1975).

While at Virginia Polytechnic Institute and State University (VPI&SU), I undertook research in a variety of areas, specializing in zoogeography and distribution of freshwater fishes in large river systems. Other areas of research which resulted in published papers include thermal studies on fishes, recovery of damaged aquatic ecosystems, and development of sampling methodology for fish and macroinvertebrates. I have authored or co-authored some 16 publications on the above areas or research. My formal education has encompassed and emphasized studies in Zoology, Aquatic Ecology, Ichthyology, and Evolutionary Biology. Prior to joining the Federal government I participated as scientific staff for a Duke University Caribbean cruise conducting oceanographic investigations, and served as a consultant, through VPI&SU, for American Electric Power Company, Koppers Company, Inc., U.S. Army Corps of Engineers, and the Tennessee Valley Authority. I was also employed by Ichthyological Associates as a field biologist investigating the fisheries resources of the Delaware Bay as part of a baseline study for several new nuclear stations.

I joined the Atomic Energy Commission, the predecessor to the NRC, in 1974 as a Fisheries Biologist performing and overseeing NEPA reviews for nuclear power reactor license applications. My principal expertise was in evaluating the impacts of various cooling system designs and intake structures on fish and shellfish in source and receiving waterbodies. In the late 1970s and early 1980s I participated in the initial licensing reviews for more than 10 sites, three alternative site reviews and investigated numerous environmental events involving aquatic resources occurring at operating nuclear power stations. In 1976, as the NRC representative, I participated in the development of U.S. Environmental Protection Agency's draft Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment as well as the 316(a) Technical Guidance Manual and Guide for Thermal Effects Sections of Nuclear Facilities Environmental Impact Statements. I also provided expert testimony at a number of NRC administrative hearings on a variety of environmental topics including shipworms, alternative site reviews, impingement and entrainment, and shortnose sturgeon. I developed the NRC staff's practices related to Commission compliance to the Endangered Species Act.

In 1982 I became the Technical Assistant to the Director of the Three Mile Island (TMI-2) Program Office. For the next 13 years I provided technical oversight on all aspects of the TMI-2 cleanup. I made over 15 containment entries at TMI-2, conducted numerous inspections and surveys developed custom technical specifications for the damaged facility, and oversaw the preparation of three supplements to the programmatic environmental impact statement on the cleanup. I provided expert testimony at an administrative hearing on the impacts of disposal of

the TMI-2 accident generated water. From 1982 to 1995 I served as the Designated Federal Official (DFO) to the NRC sponsored TMI-2 Advisory Panel. During my tenure as the DFO the panel held over 65 public meetings in the Harrisburg, PA area. In 1993, as the TMI-2 cleanup effort neared its conclusion I assumed project management responsibilities for the decommissioning of the Trojan Nuclear Power Plant. Trojan was the first large PWR to permanently cease operation and immediately begin active decontamination and dismantlement.

In 1997 I became first Acting, then Section Chief, of the Decommissioning Section in the NRC's Office of Nuclear Reactor Regulation (NRR). I was responsible for the project management of 19 permanently shutdown reactors. I also oversaw the implementation of NRC's 1996 final rule on decommissioning and the development of the 2002 Generic Environmental Impact Statement on the decommissioning of nuclear power reactors. During my tenure as Section Chief I made numerous presentations on the subject before industry, trade, and professional society meetings. In 1997, along with two coworkers, I developed and taught a one week course on reactor decommissioning at the University of Kiev, Ukraine. During my assignment to the TMI-2 cleanup effort and then as Chief of the Decommissioning Section I continued to periodically assist the NRC in the specialized areas of aquatic impact assessment and compliance with the Endangered Species Act. In the early 1990s I assisted in the development of the Generic Environmental Impact Statement for License Renewal of Nuclear Plants, and the Final Environmental Impact Statement, Operating License Stage, for the Watts Bar Nuclear Station Unit 1.

In 2001, with the transfer of the responsibility for decommissioning within the NRC to the office of Nuclear Materials Safety and Safeguards I joined the license renewal effort in NRR, again as an expert in environmental impacts assessment. Since 2001 I has served as the license renewal environmental project manager for the St. Lucie, Browns Ferry, and the Oyster Creek nuclear stations, worked on numerous other license renewals as well as several early site permits serving as the Commission's expert in aquatic and terrestrial ecology, and water intake design. I also was responsible for or assisted in conducting formal and informal endangered species consultations for a number of nuclear power stations including Crystal River, Hatch, Saint Lucie, and Turkey Point. I provided oversight in the preparation of the aquatic and in some cases the hydrological sections of the supplemental environmental impact statements for license renewal for the following both closed-cycle and once through nuclear stations: Arkansas, Turkey Point, Saint Lucie, Fort Calhoun, North Anna, Surry, Catawba, Ginna, Summer, Cook, Quad Cities, Millstone, Vermont Yankee, Nine Mile Point, Monticello, FitzPatrick and Wolf Creek.

In early 2007 I transferred to the NRC's Office of New Reactors to devote myself full time to the environmental assessment of the construction and operation of new reactors, both at existing as well as Greenfield sites, on aquatic ecosystems. I am the NRC's principal contact for endangered species concerns with the National Marine Fisheries Service (NMFS) Southeast Regional Office (SERO). I assisted in the development of the Biological Assessment for the Vogtle Early Site Permit (ESP) application that was submitted to SERO for their review. I have also provided oversight to the aquatic ecology and hydrology sections for the preparation of the environmental impact statements for the North Anna, Clinton, and Grand Gulf ESP sites. I am currently providing technical oversights to the Grand Gulf, North Anna, Bellefonte, Vogtle, and Levy Combined License Applications as well as the Vogtle ESP. I am a member of the American Fisheries Society.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
SOUTHERN NUCLEAR OPERATING CO.) Docket No. 52-011-ESP
)
(Early Site Permit for Vogtle ESP Site))

AFFIDAVIT OF REBEKAH HARTY KRIEG CONCERNING
PREFILED TESTIMONY ON ENVIRONMENTAL CONTENTIONS 1.2, 1.3 AND 6.0

I, Rebekah Harty Krieg, do declare under penalty of perjury that my statements in *NRC Staff Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.2*, in *NRC Staff Testimony of Dr. Michael T. Masnik, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 1.3*, and in *NRC Staff Testimony of Mark D. Notich, Anne R. Kuntzleman, Rebekah H. Krieg, Jill S. Caverly, and Lance W. Vail Concerning Environmental Contention EC 6.0*, as well as in my attached statement of professional qualifications are true and correct to the best of my knowledge, information, and belief.

**Executed in Accord with
10 C.F.R. § 2.304(d)**

Rebekah Harty Krieg

Executed at Richland, Washington
This 9th day of January, 2009

Resume

Rebekah Harty Krieg

Ecology Group
U.S. DOE's Pacific Northwest National Laboratory, operated by Battelle
P.O. Box 999 K6-85
Richland, WA. 99352
(509) 371-7155 (509) 371-7160 (fax)

Education:

M.S. in Fisheries and Oceanographic Sciences, University of Washington, 1983

B.S. in Biology, Washington State University, 1979.

Experience:

Senior Research Scientist (1979-2002 and 2005 – present) Battelle, Pacific Northwest National Laboratory, Richland, WA.

Technical Reviewer for the aquatic ecology sections of the Combined License (COL) application in support of the U.S. Nuclear Regulatory Commission's (NRC's) environmental evaluation of Tennessee Valley Authority's application for a COL for Bellefonte Units 3 and 4..

Technical Reviewer for the aquatic ecology sections of the Early Site Permit (ESP) application in support of the U.S. Nuclear Regulatory Commission's (NRC's) environmental evaluation of Southern Nuclear Corporation's application for an ESP for Vogtle Units 3 and 4.

Preapplication Team lead for COLs for Summer (SCEG), Bellefonte (TVA), Levy (Progress Energy), and Victoria (Exelon). Aquatic Ecology reviewer for Comanche Peak preapplication.

Technical contributor on project to assist the Army Corps of Engineers (Walla Walla District) develop configuration and operation plans for their hydroelectric projects to meet the requirements of the Biological Opinion on anadromous salmonid species listed under the Endangered Species Act.

Task leader for the Knowledge Management portion of the Infrastructure for New Reactor Environmental Reviews project. This project includes developing tools (GIS, comment databases, collaboration sites) for the Nuclear Regulatory Commission and their contractors to use during the environmental reviews that will occur when applications are received for new power reactor licenses.

Technical leader for NRC's review of license renewal applications. Managed interdisciplinary teams that provided technical support to the NRC on their review of the

environmental impacts related to the renewal of operating licenses for commercial nuclear power stations. Specifically Ms. Krieg managed the team that developed the Supplemental Environmental Impact Statement for the Oconee Nuclear Station and co-managed the teams for McGuire and Catawba.

Technical leader for development of an interdisciplinary team that provided assistance to the NRC on the development of a Supplemental Environmental Impact Statement for the Watts Bar Nuclear Plant.

Deputy Team lead for updating and revising the Environmental Standard Review Plan (ESRP), NUREG-1555.

Project Manager for assisting the NRC with development of a Generic Environmental Impact Statement (GEIS) to decommissioning of commercial nuclear power reactors. Includes the development of a revision to the Generic Environmental Impact Statement (GEIS) on Decommissioning that was originally published in 1988, development of Regulatory Guides and review plans related to the initial phases of the decommissioning process, technical review of the types of accidents that are of concern during the decommissioning process and the development of a handbook related to decommissioning for resident inspectors.

Project Manager to provide technical assistance to the NRC on the cleanup of Three Mile Island, Unit 2. Included occupational dose calculations, safety evaluations, development of supplements to a programmatic environmental impact statement, and measurement of fuel quantities remaining in the facility.

Provided technical support to the U.S. Department of Energy (DOE) in relation to the use of collective dose as a performance measurement, the development of guidance for fetal/reproductive health hazards from ionizing radiation and chemicals and extremity dosimetry.

Publications:

Krieg, RH, E.E. Hickey, J.R. Weber, and M.T. Masnik. 2004. *Nuclear Power Plants, Decommissioning of* contained in *Encyclopedia of Energy*. Cutler J. Cleveland, Editor-in-Chief. Volume 4. Elsevier Inc. Oxford, England.

Minns, JL, MT Masnik, R. Harty and EE Hickey. 2000. *Staff Response to Frequently Asked Questions Concerning Decommissioning of Nuclear Power Reactors*. NUREG-1628. U.S. Nuclear Regulatory Commission. Washington, DC.

Strom, D.J., R. Harty, E.E. Hickey, R.L. Kathren, J.B. Martin, and M.S. Peffers. 1998. *Collective Dose as a Performance Measure for Occupational Radiation Protection Programs: Issues and Recommendations*. PNL-11934. Pacific Northwest National Laboratory. Richland, Washington.

Durbin, N. E and R. Harty. *U.S. Experience with Organizational Issues During Decommissioning*. 1997. Prepared for the Swedish Nuclear Power Inspectorate. SKI 9X:X; PNWD-2419.

Harty, R., K. L. Swinth, and R. J. Traub. 1996. *Assessment and Control of Fetal Exposures. Proceedings of the Thirtieth Hanford Symposium on Health and the Environment: Current Topics in Occupational Health*. Applied Occupational and Environmental Hygiene. Vol. 11, No. 4, pp 354-358.

Harty, R., W. D. Reece, and C. D. Hooker. 1990. *Performance Testing of Extremity Dosimeters, Study 2*. NUREG/CR-5540, PNL-7276, Pacific Northwest Laboratory, Richland, Washington.

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Harty, R., and G. A. Stoetzel. 1986. *Occupational Dose Estimates for a Monitored Retrievable Storage Facility*. PNL-5744, Pacific Northwest Laboratory, Richland, Washington.

Harty, R., W. D. Reece and J. A. MacLellen. 1986. *Extremity Dosimetry at U.S. Department of Energy Facilities*. PNL-5831, Pacific Northwest Laboratory, Richland, Washington. Reece, W. D., R. Harty, L. W. Brackenbush and P. L. Roberson. 1985. *Extremity Monitoring: Considerations for Use, Dosimeter Placement, and Evaluation*. NUREG/CR-4297, U.S. Nuclear Regulatory Commission, Washington, D.C.

Munson, L. F., and R. Harty. 1985. *Possible Options for Reducing Occupational Dose from the TMI-2 Basement*. NUREG/CR-4399, U.S. Nuclear Regulatory Commission, Washington, D.C.

Parkhurst, M. A., D. E. Hadlock, R. Harty and J. L. Pappin. 1985. *Radiological Assessment of BWR Recirculatory Pipe Replacement*. NUREG/CR-4494, U.S. Nuclear Regulatory Commission, Washington, D.C.

Reece, W. D., R. T. Hadley, R. Harty, J. Glass, J. E. Tanner and L. F. Munson. 1984. *Personnel Exposure from Right Cylindrical Sources (PERCS)*. NUREG/CR-3573, U.S. Nuclear Regulatory Commission, Washington, D.C.

Fisher, D. R., and R. Harty. 1982. "The Microdosimetry of Lymphocytes Irradiated by Alpha Particles." *Int. J. Radiat. Biol.* 41(3):315-324.

W. E. Kennedy, Jr., E. C. Watson, D. W. Murphy, B. J. Harrer, R. Harty and J. M. Aldrich. 1981. *A Review of Removable Surface Contamination on Radioactive Materials Transportation Containers*. NUREG-CR/1858, PNL-3666, Pacific Northwest Laboratory, Richland, Washington.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
)
SOUTHERN NUCLEAR OPERATING CO.) Docket No. 52-011-ESP
)
(Early Site Permit for Vogtle ESP Site))

AFFIDAVIT OF DR. CHRISTOPHER B. COOK CONCERNING
PREFILED TESTIMONY ON ENVIRONMENTAL CONTENTIONS 1.2, 1.3
AND 6.0 AND REBUTTAL TESTIMONY ON ENVIRONMENTAL CONTENTION 1.2

I, Dr. Christopher B. Cook, do declare under penalty of perjury that my statements in *NRC Staff Testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Dr. Christopher B. Cook, and Lance W. Vail Concerning Environmental Contention EC 1.2 (as corrected and refiled on February 2, 2009 and February 26, 2009)*, in *NRC Staff Testimony of Dr. Michael T. Masnik, Rebekah H. Krieg, Dr. Christopher B. Cook, and Lance W. Vail Concerning Environmental Contention EC 1.3 (as corrected and refilled on February 2, 2009 and February 26, 2009)*, in *NRC Staff Testimony of Mark D. Notich, Anne R. Kuntzleman, Rebekah H. Krieg, Dr. Christopher B. Cook, and Lance W. Vail Concerning Environmental Contention EC 6.0 (as corrected and refilled on February 2, 2009 and February 26, 2009)*, and in *NRC Staff Rebuttal testimony of Dr. Michael T. Masnik, Anne R. Kuntzleman, Rebekah H. Krieg, Dr. Christopher B. Cook, and Lance W. Vail Concerning Environmental Contention EC 1.2 (as corrected and refiled on February 26, 2009)* (including to the extent it modifies my testimony in the Staff's prefiled direct testimony on EC 1.2), as well as in my attached statement of professional qualifications are true and correct to the best of my knowledge, information, and belief.

**Executed in Accord with
10 C.F.R. § 2.304(d)**

Christopher B. Cook

Executed at Rockville, Maryland
This 26th day of February, 2009

Christopher Bruce Cook
STATEMENT OF PROFESSIONAL QUALIFICATIONS

Current Position

Senior Hydrologist
Hydrologic Engineering Branch
Division of Site and Environmental Reviews
Office of New Reactors
U.S. Nuclear Regulatory Commission

Education

Ph.D., Civil and Environmental Engineering, University of California at Davis, 2000
M.S., Civil and Environmental Engineering, University of California at Davis, 1993
B.S., Civil Engineering, Colorado State University, 1991

Professional Experience

Dr. Cook joined the U.S. Nuclear Regulatory Commission in 2007. Prior to joining the NRC, he was employed as a Senior Research Engineer at the Pacific Northwest National Laboratory (PNNL) for over seven years. Dr. Cook's professional experience covers a diverse set of hydrology-related areas including basic and applied research and regulatory compliance assessments. Past research areas have focused on the use of multi-dimensional hydrodynamic and water-quality modeling of surface water systems, including simulation of complex density-driven flows in stratified environments, and field instrumentation relevant to environmental fluid mechanics.

NRC Experience

Hydrologic Reviews for New Plant Applications. Dr. Cook's duties include support of NRC reviews associated with early site permits and combined license applications. Dr. Cook is currently the lead hydrologist for the Bell Bend, Bellefonte, Grand Gulf, and North Anna combined license applications. Responsibilities associated with these reviews include preparation of hydrology-related sections of the Safety Evaluation Report (SER) and Environmental Impact Statement (EIS). Safety-related assessments include a broad range of surface water and groundwater site hazard assessments. Responsibilities on the EIS reviews include assessment of water-use and water-quality impacts to the environment from construction and operation of the proposed nuclear reactor, as well as evaluation of alternatives to the proposed action.

IAEA Safety Standard Development. Dr. Cook is currently assisting with the development of hydrology-related sections of the new International Atomic Energy Agency (IAEA) Safety Guide DS417, "Meteorological and Hydrological Hazards in Site Evaluation for Nuclear Installations." This new guide will both update and combine Safety Guide NS-G-3.5 "Flood Hazard for Nuclear Power Plants on Coastal and River Sites" and Safety Guide NS-G-3.4 "Meteorological Events in Site Evaluation for Nuclear Power Plants."

Private Sector Experience

Hydrologic Site Safety Reviews for Early Site Permits. PNNL Task Manager. Dr. Cook prepared surface water hydrology (Section 2.4) sections of the Safety Evaluation Reports (SERs) associated with the North Anna (NUREG-1835), Clinton (NUREG-1844), and Grand Gulf (NUREG-1840) early site permit applications. Assessments included a broad range of site hazards, including flooding from extreme storm events and cascade-failure of upstream dams.

Hydrology-Related Environmental Reviews for Early Site Permits. PNNL Task Manager. Dr. Cook provided assessments for the hydrology-related sections of the Environmental Impact Statements associated with the North Anna (NUREG-1811), Clinton (NUREG-1815), Grand Gulf (NUREG-1817), and Vogtle (NUREG-1872; draft) early site permit applications. Assessments include a broad range of water-use and water-quality impacts to the environment from both construction and operation of the proposed nuclear reactors.

Field Assessment and Simulation of Temperature Fluctuations in the Lower Snake River. PNNL Principal Investigator and Project Manager. Dr. Cook lead a multi-year project to monitor and model temperature fluctuations in the lower Snake River (contract totaling over \$1 million per year). He applied three-dimensional numerical models to simulate transient density currents at the confluence of the Clearwater and Snake rivers, and a two-dimensional laterally-averaged model to simulate temperature variations throughout the 140 river mile reach downstream to the confluence of the Snake and Columbia rivers. *In situ* measurements in the confluence region focused on density gradients and their impacts on juvenile Chinook salmon migration, and included the use of a wide range of field instrumentation.

Analysis and Simulation of 3-D Free-Surface Hydrodynamics near Hydroelectric Dams. PNNL Principal Investigator and Project Manager. Dr. Cook participated in and managed several free-surface computational fluid dynamics (CFD) modeling projects to compute water velocities, turbulence intensities, and pressure variations (including hydraulic loads) to assist with designing various hydraulic structures at several hydroelectric dams. Typical examples are an analysis of the spillway and tailrace conditions at The Dalles Dam (Columbia River) and simulation of entrance conditions at the Bonneville Second Powerhouse Ice and Trash Sluiceway (Columbia River).

Three-Dimensional Hydrodynamic and Water Quality Simulation of a Terminal Basin Lake. UC Davis Post-Graduate Research Engineer. While at the University of California at Davis, Dr. Cook modified and applied the multi-dimensional finite element model RMA10 to the Salton Sea, California. To calibrate and verify the model, a team lead by Dr. Cook implemented a year-long field data monitoring program to obtain *in situ* water current (ADCP) and quality (e.g. temperature, salinity, pH, and dissolved oxygen) information. Applications of the computational model focused on management alternatives to restore the Salton Sea's degrading saline environment.

Selected Publications and Technical Reports

Cook, C. B., M. C. Richmond, and J. A. Serkowski. (2007). "Observations of Velocity Conditions near a Hydroelectric Turbine Draft Tube Exit using ADCP Measurements." *Journal of Flow Measurement and Instrumentation*, 18(3):148-155.

Cook, C. B., G. A. McMichael, J. A. Vucelick, B. Dibrani, E. E. Hockersmith, C. A. Duberstein, I. D. Welch, B. J. Bellgraph, C. A. McKinstry, P. S. Titzler, D. A. Ogden, B. P. Sandford, R. K. Kirkham, and M. D. Bleich. (2007). "Lower Monumental Reservoir Juvenile Fall Chinook Salmon Behavior Studies." *Battelle–Pacific Northwest Division*, PNWD-3800, Richland, Washington, July.

Cook, C. B., B. Dibrani, J. A. Serkowski, M. C. Richmond, P. S. Titzler, and G. W. Dennis. (2006). "Acoustic Doppler Current Profiler Measurements in the Tailrace at John Day Dam." *Pacific Northwest National Laboratory*, PNNL-15627, Richland, Washington, January.

Cook, C. B., B. Dibrani, M. C. Richmond, M. D. Bleich, S. P. Titzler, and T. Fu. (2006). "Hydraulic Characteristics of the Lower Snake River during Periods of Juvenile Fall Chinook Salmon Migration." *Pacific Northwest National Laboratory*, PNNL-15532, Richland, Washington, January.

Johnson, G. E., M. E. Hanks, F. Khan, C. B. Cook, J. Hedgepeth, R. P. Mueller, C. L. Rakowski, M. C. Richmond, S. L. Sargeant, J. A. Serkowski, and J. R. Skalski. (2005). "Hydroacoustic Evaluation of Juvenile Salmonid Passage at The Dalles Dam in 2004." *Pacific Northwest National Laboratory*, PNNL-15180, Richland, Washington.

Johnson, R. L., M. A. Simmons, C. A. McKinstry, C. S. Simmons, C. B. Cook, R. S. Brown, D. K. Tano, S. L. Thorsten, R. LeCaire, and S. Francis. (2005). "Strobe Light Deterrent Efficacy Test and Fish Behavior Determination at Grand Coulee Dam Third Powerplant Forebay." *Pacific Northwest National Laboratory*, PNNL-15007, Richland, Washington, February.

Cook, C. B., L. W. Vail, and D. L. Ward. (2005). "Report on the North Anna Early Site Permit Water Budget Model (LakeWBT) for Lake Anna." *Pacific Northwest National Laboratory*, PNNL-14944, Richland, Washington, January.

Cook, C. B. and M. C. Richmond. (2004). "Simulating the Flow Field Upstream of the Dworshak Dam Regulating Outlets." *Pacific Northwest National Laboratory*, PNNL-14591, Richland, Washington, March.

Cook, C. B. and M. C. Richmond. (2004). "Monitoring and Simulating 3-D Density Currents at the Confluence of the Snake and Clearwater Rivers", in *Critical Transitions in Water and Environmental Resources Management*, eds. G. Sehike, D. Hayes and D. Stevens, American Society of Civil Engineering Press, 2004.

Cook, C. B., C. L. Rakowski, M. C. Richmond, S. P. Titzler, A. M. Coleman, and M. D. Bleich. (2003). "Numerically Simulating the Hydrodynamic and Water Quality Environment for Migrating Salmon in the Lower Snake River." *Pacific Northwest National Laboratory*, PNNL-14297, Richland, Washington.

Cook, C. B., G. T. Orlob, and D. W. Huston. (2002). "Simulation of Wind-Driven Circulation in the Salton Sea: Implications for Indigenous Ecosystems." *Hydrobiologia*, 473: 59-75.

Cook, C. B., and M. C. Richmond. (2001). "Simulation of Tailrace Hydrodynamics using Computational Fluid Dynamics (CFD) Models." *Pacific Northwest National Laboratory*, PNNL-13467, Richland, Washington.

Cook, C.B. (2000). "Internal Dynamics of a Terminal Basin Lake: A Numerical Model for Management of the Salton Sea." Ph.D. dissertation, Department of Civil and Environmental Engineering, University of California, Davis.

Cook, C.B. (1993). "A One-Dimensional Model to Simulate Water Infiltration and Redistribution in Soils." M.S. thesis, Department of Civil and Environmental Engineering, University of California, Davis.

Abt, S. R., C. B. Cook, K. Staker, and D. Johns. (1991). "Small Parshall Flume Rating Corrections." *Journal of Hydraulic Engineering*, American Society of Civil Engineering, 118(5): 798-802.

Selected Conference Proceedings

Cook, C. B., G. A. McMichael, J. A. Vucelick, and B. Dibrani (2007). "Interactions between underflow conditions in a reservoir and emigration of juvenile fall Chinook salmon", *American Fisheries Society Annual Meeting*, San Francisco, September.

Prasad, R., L. W. Vail, C. B. Cook, and G. Bagchi. (2005). "Establishment of Safety-Related Site Characteristics Based on Consideration of External Sources of Flooding at Nuclear Power Plant Sites in the United States of America." In *Proceedings of International Workshop on External Flooding Hazards at Nuclear Power Plant Sites*, Kalpakkam, India, August.

Cook, C. B., M. C. Richmond, J. A. Serkowski, and L. L. Ebner. (2002). "Free-Surface Computational Fluid Dynamics Modeling of a Spillway and Tailrace: Case Study of The Dalles Project." *Hydrovision 2002*, Portland, Oregon, July.

Cook, C. B., D. W. Huston, M. R. Jensen, G. T. Orlob, and S. G. Schladow. (1998). "Internal Dynamics of a Large Saline Lake: Field Investigation and Monitoring of the Salton Sea, California." *1998 Ocean Sciences Meeting*, AGU and ASLO, San Diego, February.

Professional Affiliations

American Society of Civil Engineers
American Geophysical Union